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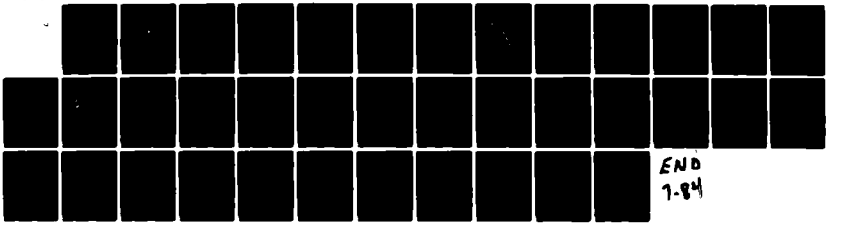

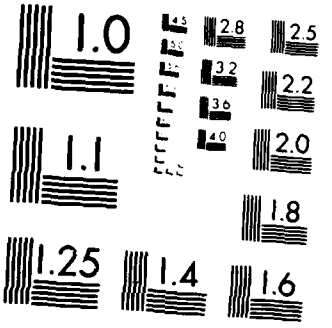

NPS68-84-005

NAVAL POSTGRADUATE SCHOOL

Monterey, California

HYDROGRAPHIC DATA FROM THE OPTOMA PROGRAM
OPTOMA1
8 to 13 MARCH, 1982

by

Michele M. Rienecker
Christopher N.K. Mooers
Marie C. Colton
Paul A. Wittmann

April 1984

Prepared for:
Office of Naval Research
Environmental Sciences Directorate (Code 420)
Arlington, VA 22217

NAVAL POSTGRADUATE SCHOOL

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The cruise OPTOMA1 was undertaken in March, 1982 to sample a subdomain of the California Current System. This report presents the hydrographic data, acquired by XBT casts, from the cruise.

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Hydrographic Data from the **OPTOMA** *Program:*
OPTOMA1
March 8 - 13, 1982

by

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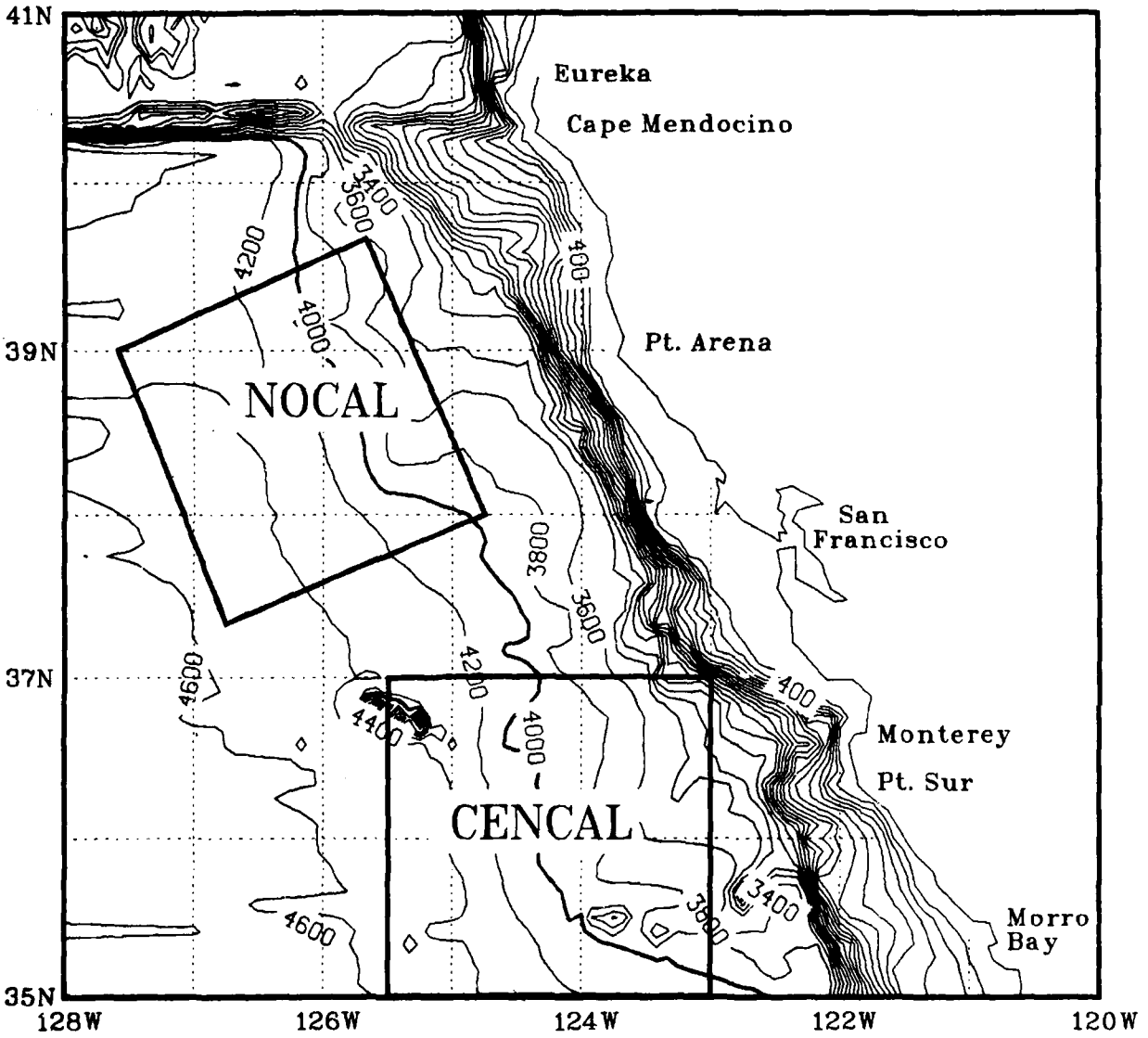

Figure 1:

The NOCAL and CENCAL subdomains of the OPTOMA Program. Isobaths are shown in meters.

INTRODUCTION

The OPTOMA (Ocean Prediction Through Observations, Modeling and Analysis) Program, a joint NPS/Harvard program sponsored by ONR, seeks to understand the mesoscale (fronts, eddies, and jets) variability and dynamics of the California Current System and to determine the scientific limits to practical mesoscale ocean forecasting. To help carry out the aims of this project, a series of cruises has been planned in two subdomains, NOCAL and CENCAL, shown in Figure 1.

The cruise OPTOMA1 was undertaken, on the R/V ACANIA, in March, 1982 and covered part of the NOCAL domain which is roughly 200 km square centered 150 km off the California coast.

From March 8 to 13, hydrographic data were acquired along the tracks shown in Figure 2. In the rectangular domain, roughly 90 km across-shore by 120 km alongshore, the series of parallel transects directed alongshore were separated by about 18 km. Along-track station spacing was about 8.8 km. In addition, there were tracks to and from the domain.

DATA ACQUISITION

During OPTOMA1 XBT profiles, bucket surface temperature and water samples for salinity were taken at every station. Continuous 2 m thermalsalinograph measurements and meteorological data such as atmospheric pressure at a height of 2 m and wind speed and direction at a height of 20 m were also recorded. The XBT profiles were recorded as analogue traces. The continuous "underway" data were digitized using an HP 5328 frequency counter and a 40 channel digital voltmeter, averaged over one-minute intervals and recorded, using an HP 9835 computer, on data cassettes.

Station positions were determined by Loran C fixes and are claimed to be accurate to within about 0.1 km. The probe on the Sippican Expendable Bathythermograph (XBT) has an accuracy of $\pm$0.2C in temperature and $\pm$2% or 4.6 m (whichever is greater) in depth. The 2 m underway sensors are from SEA-BIRD Electronics. The temperature sensor, a glass-coated thermistor bead, has an accuracy of $\pm$0.003C; the conductivity sensor, a two-terminal flow-through electrode cell, has an accuracy of $\pm$0.003 mmho/cm.

The surface salinity from the bottom samples were determined ashore by a Guildline Model 8400 "Autosal" salinometer with an accuracy of ±0.003 ppt. The Table on page 4 summarizes the various sensors available on the R/V ACANIA and their accuracy.

DATA PROCESSING

The XBT traces were digitized at the surface and points of inflection to an accuracy of 0.01C by Fleet Numerical Oceanography Center (FNOC). These data were then transferred to the IBM 3033 mainframe at the Naval Postgraduate School and edited by removing obvious cast failures that were not identified during the cruise or digitization procedure. Approximately 96% of casts were retained in the data set.

The data have been transferred on digital tape to the National Oceanographic Data Center in Washington, DC.

DATA PRESENTATION

The cruise track, station locations and station numbers are shown in the first three figures of the next section. These figures are followed by a listing of the stations, with their coordinates, the date and time at which the station was occupied, and the surface information obtained at the station.

Vertical profiles of temperature from the XBT casts are shown in staggered fashion. The location of these profiles may be found by reference to the various maps of the cruise track. Transect extremes are identified as nearly as possible. The first profile on each plot is shown with its temperature unchanged; to each subsequent profile an appropriate multiple of 5C has been added.

Isotherms for each transect are shown in the Figure 6. Based on instrument accuracy and the vertical temperature gradient, it is estimated that the depths of isotherms in the main thermocline are uncertain to ±20m. The tick marks identify station positions and, again, the transect extremes are shown on these plots. The data presentation concludes with a plot of mean and ± standard deviation profiles of temperature from XBT's.

SCIENTIFIC INSTRUMENTS ABOARD THE R/V ACANIA

Instrument	Variable	Sensor	Accuracy	Resolution
*Neil Brown CTD Mark IIIb	pressure	strain gage	1.6 db	0.025 db
	temperature	thermistor	0.005 C	0.0005 C
	conductivity	electrode cell	0.005 mmho	0.001 mmho
Sippican BT	temperature	thermistor	0.2 C	
	depth	descent speed	max. of 4.6 m and 2% of depth	
Guildline Autosal	conductivity	electrode cell	0.003 ppt	0.0002 ppt
* Amatek Straza ADVP	velocity profiles to 100m	4 beam sonar	3 cm/sec relative to ship speed	3 cm/sec
* Rosemount Sensor	sea surface temperature	platinum thermometer	0.05 C	0.005 C
Sea-Bird Sensors	temperature	thermistor	0.003 C	0.0005 C
	conductivity at 2 meters	electrode cell	0.003 mmho	0.0005 mmho
Rosemount Sensor	air temperature	thermometer	0.01 C	
Kavolico Barometer	atmospheric pressure	pressure transducer	1.5 mb	0.1 mb
1200 EPS Hygrometer	dew point	condensation temp. sensor	0.2 C	0.02 C
Meteorology Res. Inc.	wind speed	anemometer	0.15 mph or 1%	
Meteorology Res. Inc.	wind direction	vane	2.5 degrees	
Internav LC408 LORAN C	position	two chain LORAN receiver	100 meters	10 meters
Motorola Miniranger	position	microwave transponders	4 meters	2 meters

* Not operating on OPTOMA1 cruise.

OPTOMA1

8 to 13 MARCH, 1982

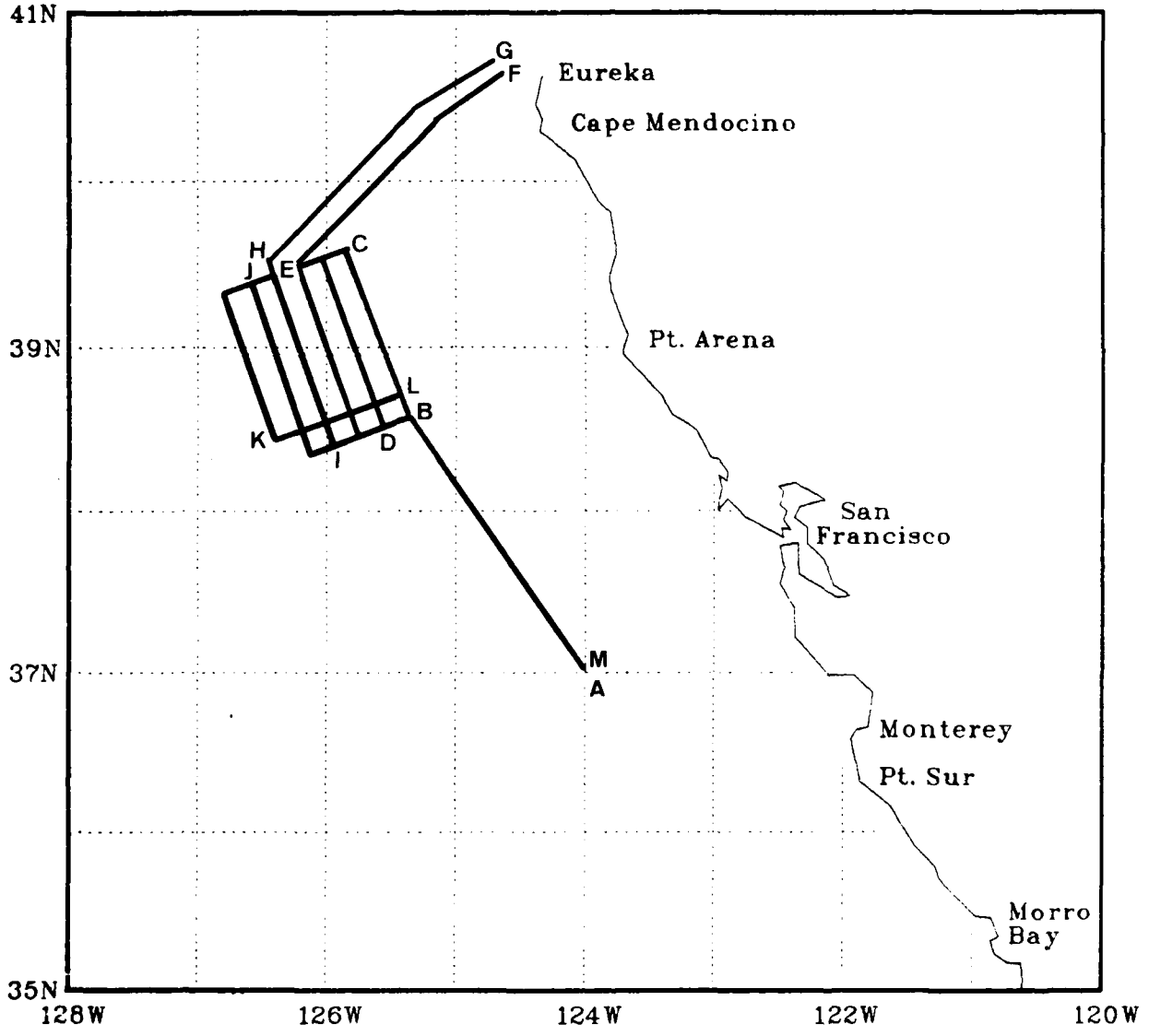

Figure 2:

Cruise track for OPTOMAI with transect extremes identified by letter.

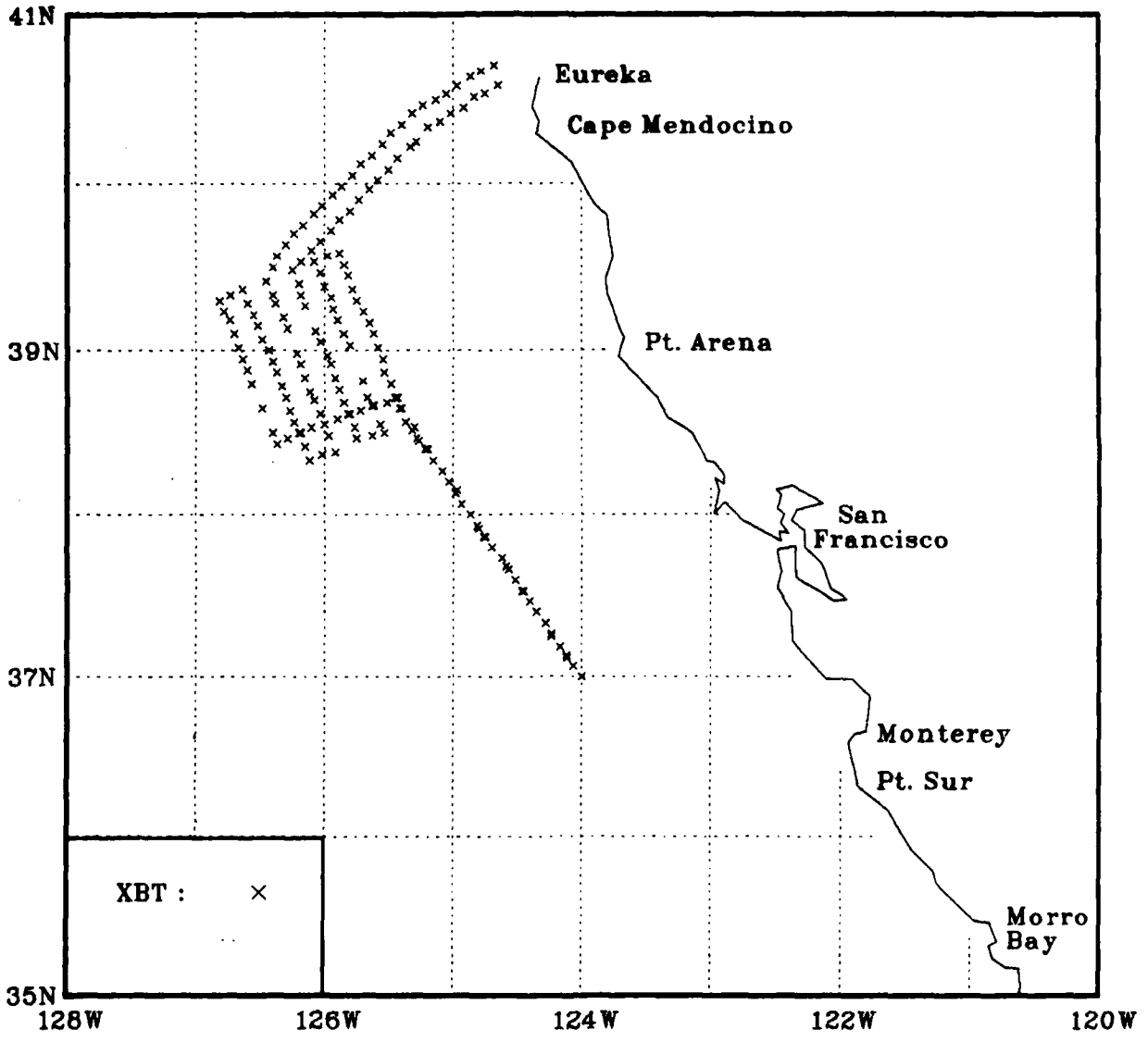

Figure 3:

XBT locations for OPTOMA1.

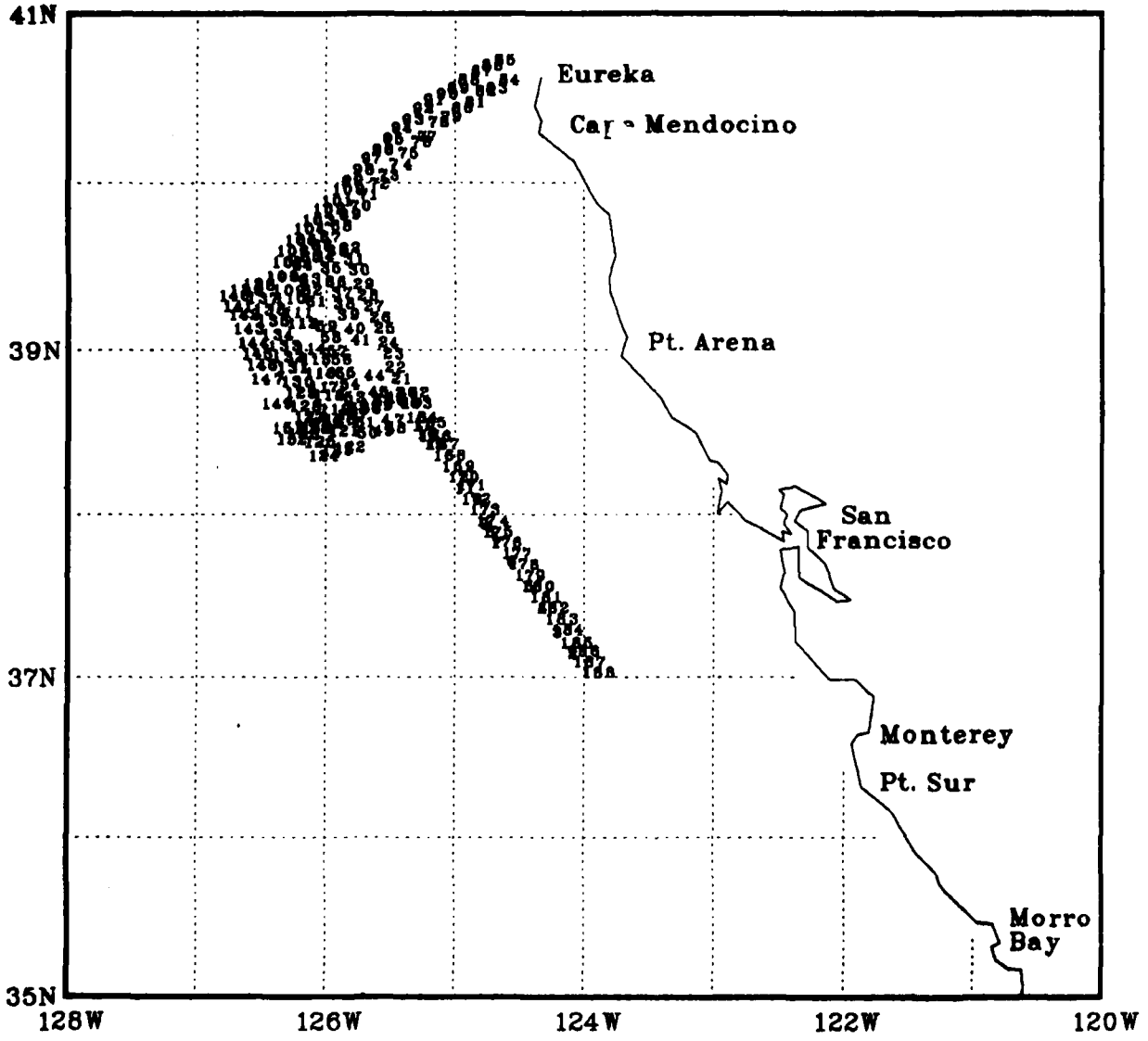

Figure 4:

Station numbers for OPTOMA1.

XBT STATION LISTING

STN	TYPE	YR/DAY	GMT	LAT (NORTH)	LONG (WEST)	SURFACE TEMP (DEG C)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
1	XBT	82067	1504	37.00	124.00	12.3	12.2	-----
2	XBT	82067	1606	37.07	124.07	12.0	12.0	-----
3	XBT	82067	1708	37.15	124.14	12.3	12.4	-----
4	XBT	82067	1818	37.24	124.21	12.2	12.3	-----
5	XBT	82067	1919	37.32	124.27	12.6	12.8	-----
6	XBT	82067	2020	37.41	124.35	13.0	13.2	32.73
7	XBT	82067	2122	37.48	124.42	12.5	13.0	-----
8	XBT	82067	2153	37.52	124.45	12.6	12.8	-----
9	XBT	82067	2219	37.55	124.48	12.5	12.6	-----
10	XBT	82067	2322	38.04	124.56	11.3	11.7	-----
11	XBT	82067	2352	38.08	124.59	11.6	11.7	-----
12	XBT	82067	23	38.12	125.02	12.0	11.9	-----
15	XBT	82067	158	38.24	125.13	11.5	11.4	-----
16	XBT	82067	229	38.28	125.17	11.4	11.5	-----
17	XBT	82067	254	38.31	125.19	11.4	11.6	-----
18	XBT	82067	329	38.34	125.22	11.5	11.5	-----
19	XBT	82067	406	38.39	125.24	11.5	11.4	-----
20	XBT	82067	431	38.43	125.27	11.2	11.3	-----
21	XBT	82067	506	38.48	125.29	11.2	11.2	-----
22	XBT	82067	532	38.52	125.32	11.2	11.2	-----
23	XBT	82067	600	38.57	125.33	11.2	11.2	-----
24	XBT	82067	631	39.01	125.35	11.0	11.2	32.75
25	XBT	82067	703	39.06	125.37	11.2	11.1	32.72
26	XBT	82067	730	39.10	125.39	11.1	11.1	32.75
27	XBT	82068	801	39.14	125.42	11.0	11.1	32.75
28	XBT	82068	829	39.18	125.45	11.2	11.2	32.78
29	XBT	82068	856	39.22	125.47	11.1	11.1	32.77
30	XBT	82068	925	39.27	125.49	10.9	11.1	32.75
31	XBT	82068	955	39.31	125.51	11.1	11.1	32.78
32	XBT	82068	1026	39.35	125.53	11.1	11.1	-----
33	XBT	82068	1056	39.34	125.59	11.1	11.1	32.78
34	XBT	82068	1127	39.32	126.05	11.2	11.2	32.81
35	XBT	82068	1209	39.28	126.02	11.0	11.0	32.73
36	XBT	82068	1244	39.23	126.00	11.1	11.0	32.73
37	XBT	82068	1315	39.19	125.57	11.1	11.0	32.71
38	XBT	82068	1349	39.15	125.56	11.0	11.1	32.67
39	XBT	82068	1416	39.11	125.54	11.2	11.4	32.69
40	XBT	82068	1452	39.06	125.51	11.5	11.4	32.69
41	XBT	82068	1521	39.02	125.48	11.5	11.4	32.70
44	XBT	82068	1702	38.49	125.42	11.6	11.5	32.72
45	XBT	82068	1732	38.43	125.40	11.6	11.5	32.71
46	XBT	82068	1806	38.40	125.38	11.6	11.5	32.71
47	XBT	82068	1859	38.33	125.34	11.5	11.5	32.70
48	XBT	82068	1924	38.30	125.32	11.6	11.5	32.71

STN	TYPE	YR/DAY	GMT	LAT (NORTH)	LONG (WEST)	SURFACE TEMP (DEG C)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
49	XBT	82068	2006	38.29	125.38	11.5	11.5	32.71
50	XBT	82068	2045	38.28	125.45	11.6	11.5	32.71
51	XBT	82068	2115	38.32	125.46	11.5	11.5	32.72
52	XBT	82068	2146	38.37	125.49	11.6	11.5	32.73
53	XBT	82068	2216	38.41	125.51	11.6	11.6	32.76
54	XBT	82068	2248	38.46	125.53	11.9	11.6	32.75
55	XBT	82068	2319	38.50	125.55	11.9	11.6	32.74
56	XBT	82068	2354	38.55	125.57	11.8	11.5	32.74
57	XBT	82068	19	38.58	125.59	11.6	11.5	32.74
58	XBT	82068	51	39.03	126.02	11.6	11.4	32.72
59	XBT	82068	122	39.07	126.04	11.7	11.4	32.76
61	XBT	82068	235	39.16	126.09	11.5	11.3	32.70
62	XBT	82068	302	39.20	126.11	11.5	11.3	32.70
63	XBT	82068	330	39.24	126.12	11.2	11.0	32.65
64	XBT	82068	403	39.29	126.15	11.1	10.9	32.64
65	XBT	82068	439	39.32	126.11	11.0	10.9	32.69
66	XBT	82068	509	39.36	126.06	11.0	11.0	32.94
67	XBT	82068	550	39.39	126.02	11.0	10.9	32.64
68	XBT	82068	626	39.43	125.57	11.0	10.9	32.66
69	XBT	82068	658	39.47	125.53	11.0	10.8	32.63
70	XBT	82068	732	39.50	125.48	11.4	11.0	32.70
71	XBT	82069	801	39.54	125.44	11.1	11.0	32.72
72	XBT	82069	835	39.58	125.39	11.2	11.0	32.73
73	XBT	82069	907	40.01	125.35	11.2	11.0	32.76
74	XBT	82069	942	40.05	125.30	11.3	11.1	32.73
75	XBT	82069	1015	40.09	125.26	11.4	11.1	32.72
76	XBT	82069	1051	40.13	125.20	11.1	11.0	32.74
77	XBT	82069	1115	40.15	125.17	10.9	11.0	32.70
78	XBT	82069	1146	40.20	125.12	10.9	11.0	32.70
79	XBT	82069	1217	40.22	125.06	11.2	11.1	32.71
80	XBT	82069	1248	40.25	125.01	11.2	11.1	32.74
81	XBT	82069	1317	40.27	124.55	11.0	11.1	32.73
82	XBT	82069	1354	40.31	124.50	11.4	11.1	32.73
83	XBT	82069	1421	40.32	124.45	11.2	11.3	32.82
84	XBT	82069	1450	40.35	124.39	11.0	11.1	32.71
85	XBT	82069	2023	40.42	124.41	10.9	11.2	32.74
86	XBT	82069	2059	40.40	124.47	11.1	11.1	32.72
87	XBT	82069	2130	40.38	124.52	11.2	11.1	32.74
88	XBT	82069	2204	40.35	124.58	11.6	11.2	32.74
89	XBT	82069	2236	40.32	125.03	11.4	11.3	32.74
90	XBT	82069	2306	40.30	125.08	11.9	11.4	32.76
91	XBT	82069	2338	40.28	125.14	11.5	11.5	32.69
92	XBT	82069	13	40.25	125.19	11.7	11.7	32.72
93	XBT	82069	48	40.21	125.24	12.0	11.8	32.71
94	XBT	82069	117	40.18	125.29	12.0	11.8	32.70
95	XBT	82069	151	40.14	125.33	12.3	11.7	32.70
96	XBT	82069	223	40.10	125.38	11.9	11.7	32.72
97	XBT	82069	256	40.07	125.43	11.0	11.2	32.71

STN	TYPE	YR/DAY	GMT	LAT (NORTH)	LONG (WEST)	SURFACE TEMP (DEG C)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
98	XBT	82069	328	40.03	125.47	11.6	11.3	32.73
99	XBT	82069	400	39.59	125.52	11.5	11.4	32.68
100	XBT	82069	429	39.56	125.56	11.5	11.4	32.66
101	XBT	82069	504	39.52	126.01	11.5	11.4	32.65
102	XBT	82069	529	39.49	126.05	11.5	11.3	32.66
103	XBT	82069	603	39.45	126.10	11.4	11.2	32.66
104	XBT	82069	630	39.42	126.14	11.5	11.3	32.68
105	XBT	82069	704	39.38	126.18	11.2	11.2	32.65
106	XBT	82069	748	39.34	126.22	11.7	11.4	32.66
107	XBT	82070	816	39.30	126.24	11.6	11.4	32.66
108	XBT	82070	850	39.25	126.27	11.6	11.4	32.66
109	XBT	82070	919	39.20	126.24	11.7	11.5	32.67
110	XBT	82070	947	39.17	126.23	11.7	11.6	32.67
111	XBT	82070	1023	39.12	126.19	11.5	11.6	32.67
112	XBT	82070	1050	39.08	126.17	11.8	11.6	32.68
114	XBT	82070	1151	38.59	126.13	11.7	11.5	32.66
115	XBT	82070	1218	38.55	126.11	11.6	11.5	32.66
116	XBT	82070	1340	38.50	126.09	12.0	11.7	32.73
117	XBT	82070	1418	38.45	126.07	12.3	11.9	32.74
118	XBT	82070	1443	38.42	126.05	11.8	11.7	32.69
119	XBT	82070	1514	38.37	126.02	11.9	11.7	32.69
120	XBT	82070	1542	38.33	126.00	12.0	11.9	32.73
121	XBT	82070	1612	38.29	125.58	11.9	11.9	32.74
122	XBT	82070	1649	38.23	125.55	12.0	11.9	32.71
123	XBT	82070	1724	38.22	126.01	11.9	11.8	32.72
124	XBT	82070	1753	38.20	126.07	12.0	12.0	32.77
125	XBT	82070	1827	38.25	126.09	12.1	12.0	32.75
126	XBT	82070	1858	38.30	126.12	11.9	11.9	32.74
127	XBT	82070	1925	38.34	126.14	11.9	11.9	32.72
128	XBT	82070	1955	38.38	126.16	11.9	11.7	32.71
129	XBT	82070	2029	38.43	126.18	11.3	11.4	-----
130	XBT	82070	2159	38.47	126.20	11.5	11.2	32.67
131	XBT	82070	45	38.52	126.22	11.6	11.2	32.73
132	XBT	82070	252	38.56	126.24	11.7	11.3	32.74
133	XBT	82070	454	39.00	126.26	11.5	11.7	32.73
134	XBT	82070	651	39.04	126.29	11.2	11.1	32.71
135	XBT	82071	840	39.09	126.31	11.1	10.4	32.65
136	XBT	82071	1029	39.13	126.33	10.9	10.6	32.67
137	XBT	82071	1231	39.17	126.36	11.1	10.6	32.67
138	XBT	82071	1427	39.22	126.38	11.2	10.9	32.68
139	XBT	82071	1521	39.20	126.44	11.1	10.8	32.67
140	XBT	82071	1601	39.18	126.49	11.2	11.0	32.72
141	XBT	82071	1629	39.14	126.47	11.3	11.0	32.71
142	XBT	82071	1655	39.11	126.44	11.2	11.0	32.72
143	XBT	82071	1723	39.06	126.42	11.2	11.1	32.57
144	XBT	82071	1754	39.01	126.40	11.0	10.8	32.65
145	XBT	82071	1823	38.57	126.38	11.3	----	32.76
146	XBT	82071	1849	38.53	126.36	11.6	11.4	32.75

STN	TYPE	YR/DAY	GMT	LAT (NORTH)	LONG (WEST)	SURFACE TEMP (DEG C)	BUCKET TEMP (DEG C)	BOTTLE SALINITY (PPT)
147	XBT	82071	1916	38.48	126.34	11.9	11.5	32.78
149	XBT	82071	2020	38.39	126.29	11.4	11.2	32.71
151	XBT	82071	2121	38.30	126.24	11.5	11.3	32.71
152	XBT	82071	2142	38.26	126.22	11.5	11.3	32.74
153	XBT	82071	2215	38.28	126.17	11.6	11.4	32.76
154	XBT	82071	2250	38.30	126.11	11.6	11.5	32.74
155	XBT	82071	2322	38.32	126.06	11.6	11.4	32.72
157	XBT	82071	35	38.35	125.54	11.7	11.5	32.74
158	XBT	82071	100	38.37	125.48	11.7	11.3	32.74
159	XBT	82071	137	38.38	125.43	11.5	11.3	32.76
160	XBT	82071	208	38.40	125.37	11.4	11.3	32.73
161	XBT	82071	247	38.41	125.31	11.4	11.2	32.70
162	XBT	82071	315	38.43	125.26	11.2	11.0	32.68
163	XBT	82071	335	38.39	125.25	11.5	11.0	32.69
164	XBT	82071	419	38.34	125.22	11.5	11.2	32.72
165	XBT	82071	441	38.32	125.18	11.3	11.1	32.71
166	XBT	82071	513	38.27	125.16	11.5	11.4	32.78
167	XBT	82071	541	38.24	125.12	11.9	11.6	32.83
168	XBT	82071	610	38.20	125.09	12.0	11.7	32.85
169	XBT	82071	644	38.16	125.05	12.0	11.4	32.85
170	XBT	82072	858	38.12	125.02	11.7	11.3	32.76
171	XBT	82072	927	38.09	124.58	12.0	11.5	32.82
172	XBT	82072	1002	38.04	124.56	12.1	11.7	32.85
173	XBT	82072	1036	38.00	124.52	12.5	11.8	32.84
174	XBT	82072	1106	37.56	124.49	12.4	12.0	32.89
175	XBT	82072	1134	37.52	124.46	12.9	12.5	32.96
176	XBT	82072	1205	37.48	124.42	13.0	12.5	32.99
177	XBT	82072	1238	37.44	124.37	13.0	----	-----
178	XBT	82072	1308	37.40	124.34	12.8	12.3	32.94
179	XBT	82072	1337	37.36	124.31	12.7	12.3	32.92
180	XBT	82072	1404	37.32	124.28	12.5	12.2	32.91
181	XBT	82072	1433	37.28	124.24	12.7	12.5	32.95
182	XBT	82072	1515	37.24	124.21	12.7	12.4	32.89
183	XBT	82072	1547	37.20	124.17	12.1	11.8	32.63
184	XBT	82072	1613	37.16	124.14	12.0	11.7	-----
185	XBT	82072	1657	37.11	124.10	11.8	11.6	-----
186	XBT	82072	1717	37.08	124.07	11.8	11.7	32.70
187	XBT	82072	1749	37.04	124.04	12.0	11.8	32.89
188	XBT	82072	1816	37.00	124.00	11.9	11.7	32.84

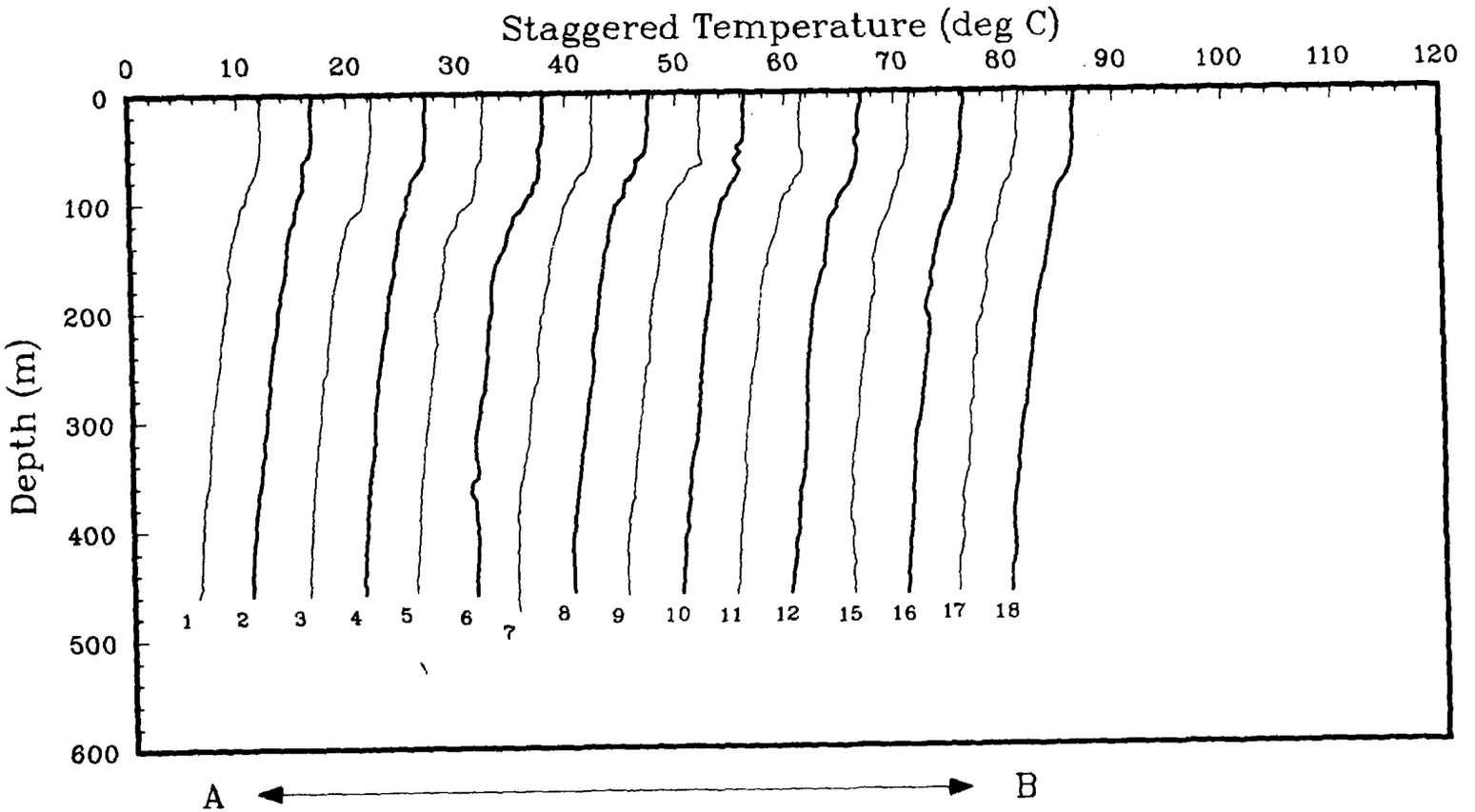

Figure 5(a):

Staggered temperature profiles from the XBTs. Profiles are staggered by a multiple of 5C.

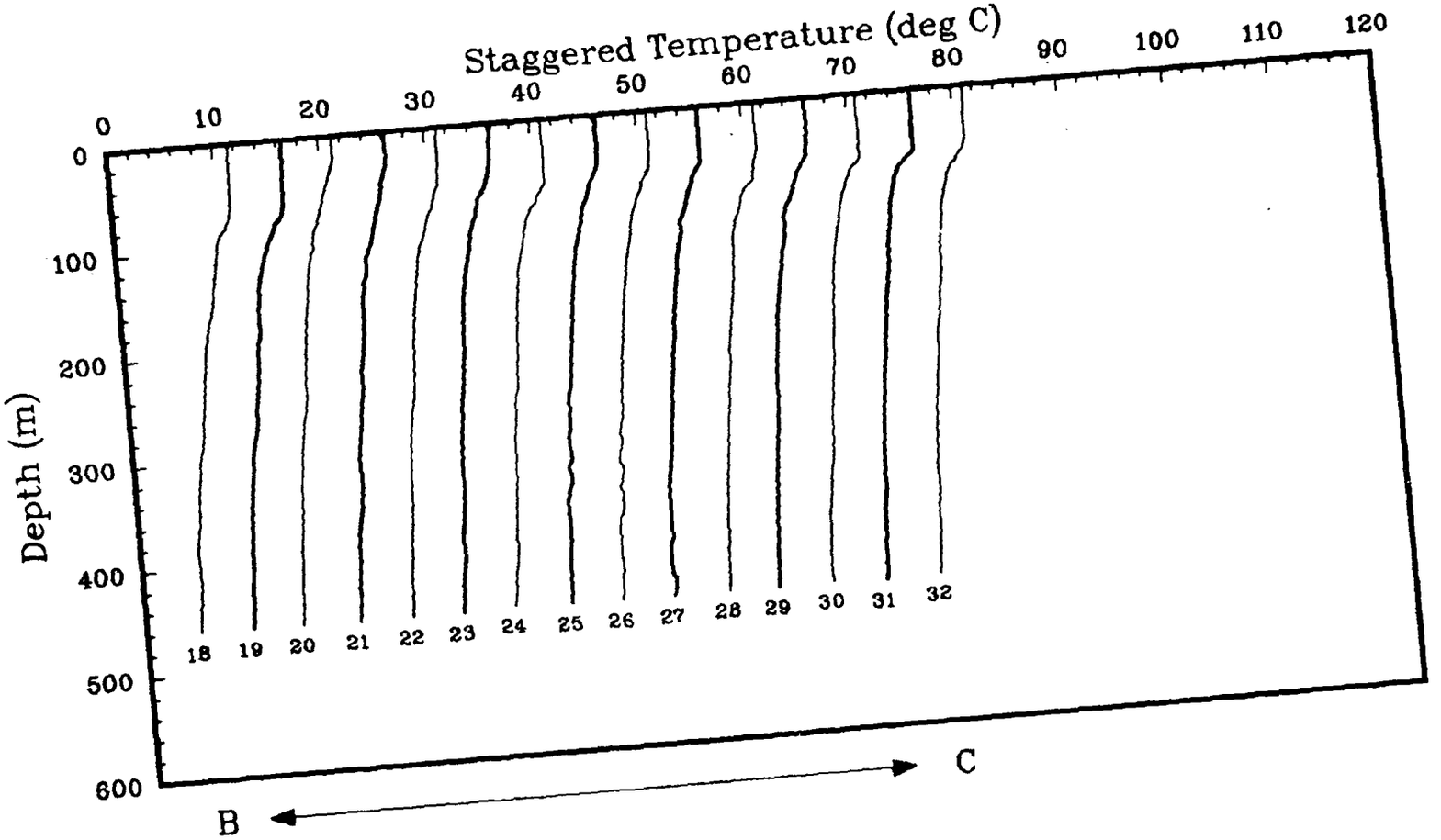
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
B
C

Figure 5(b).

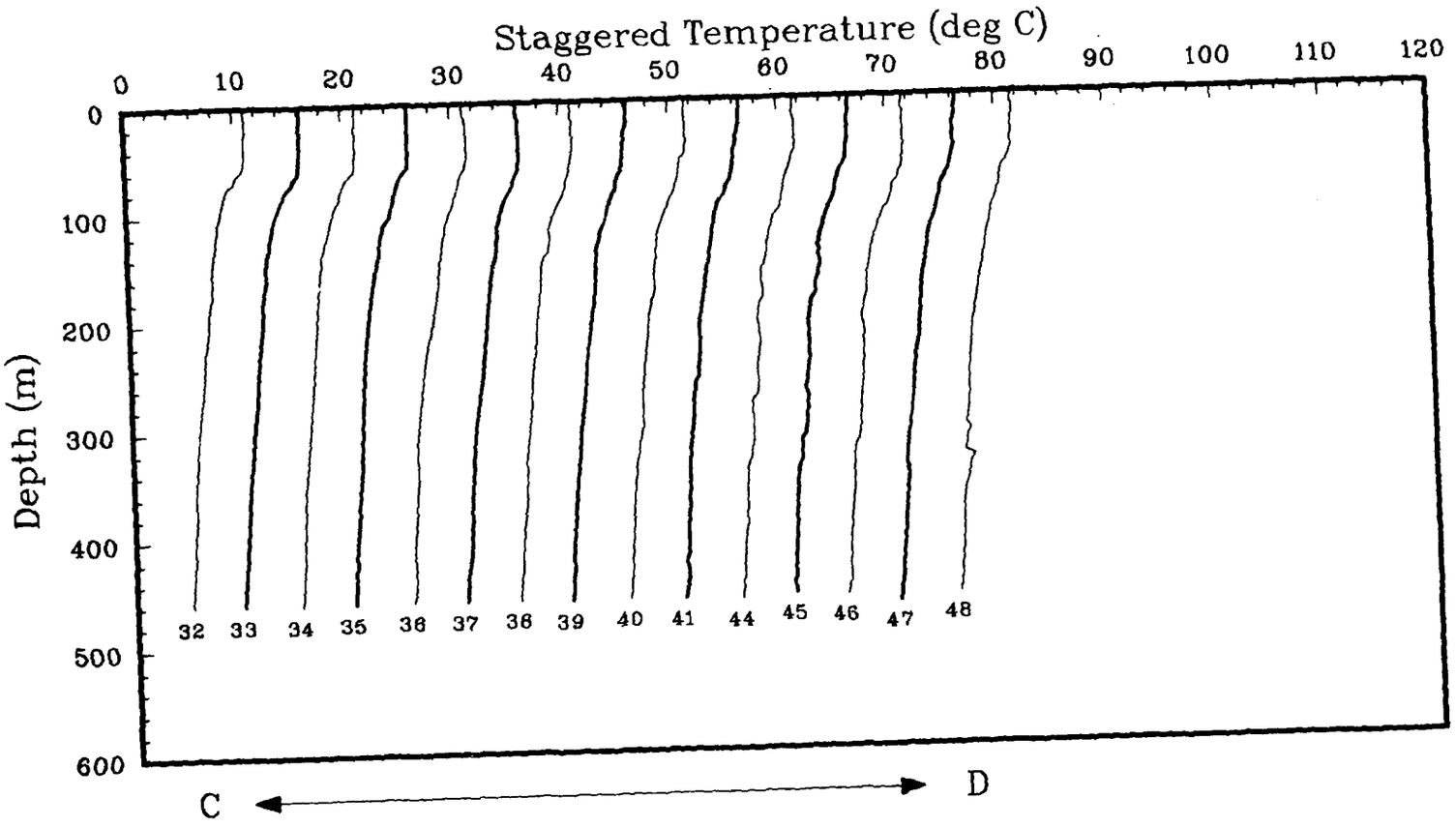
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
32
33
34
35
36
37
38
39
40
41
44
45
46
47
48
C
D

Figure 5(c).

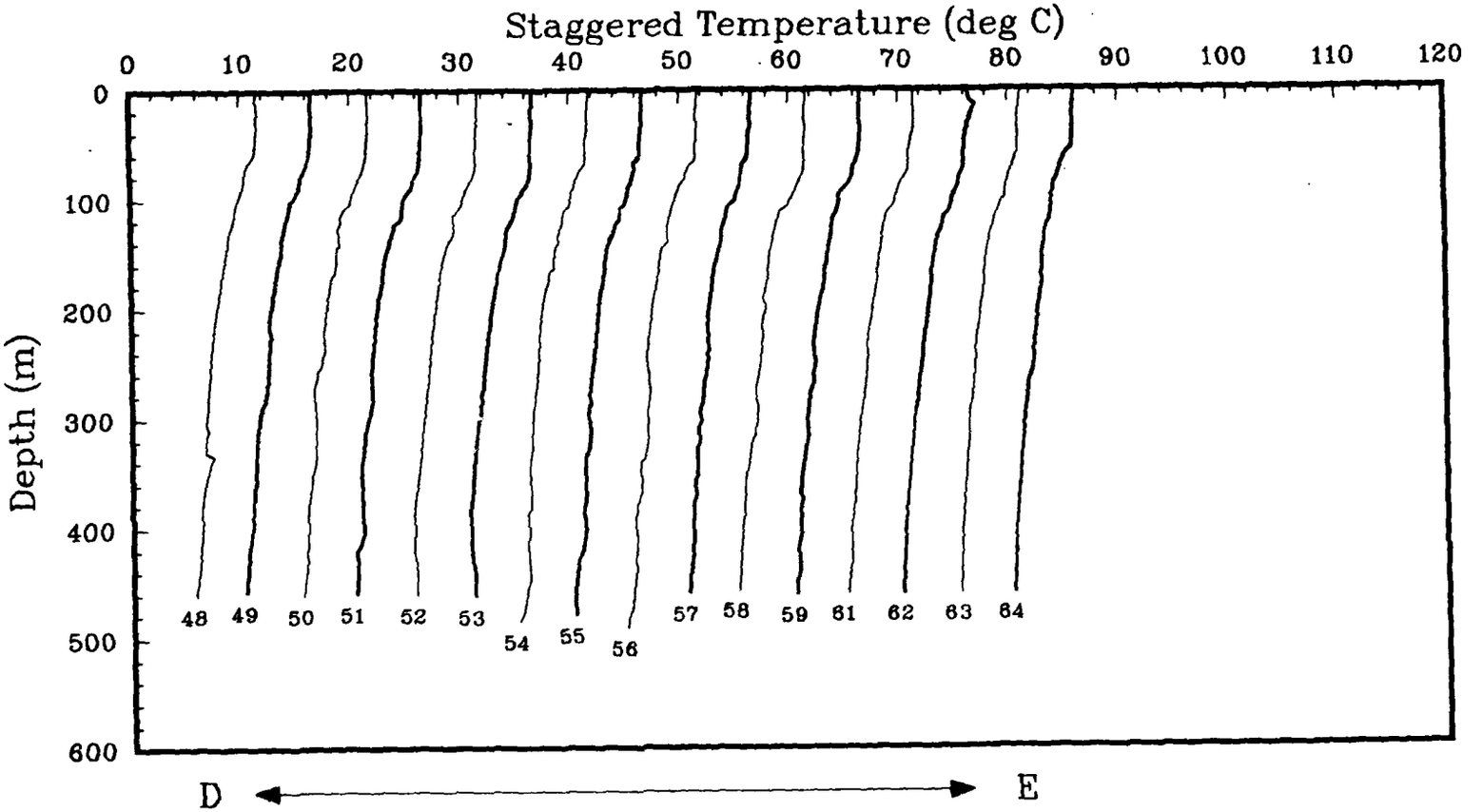
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
48
49
50
51
52
53
54
55
56
57
58
59
61
62
63
64
D
E

Figure 5(d).

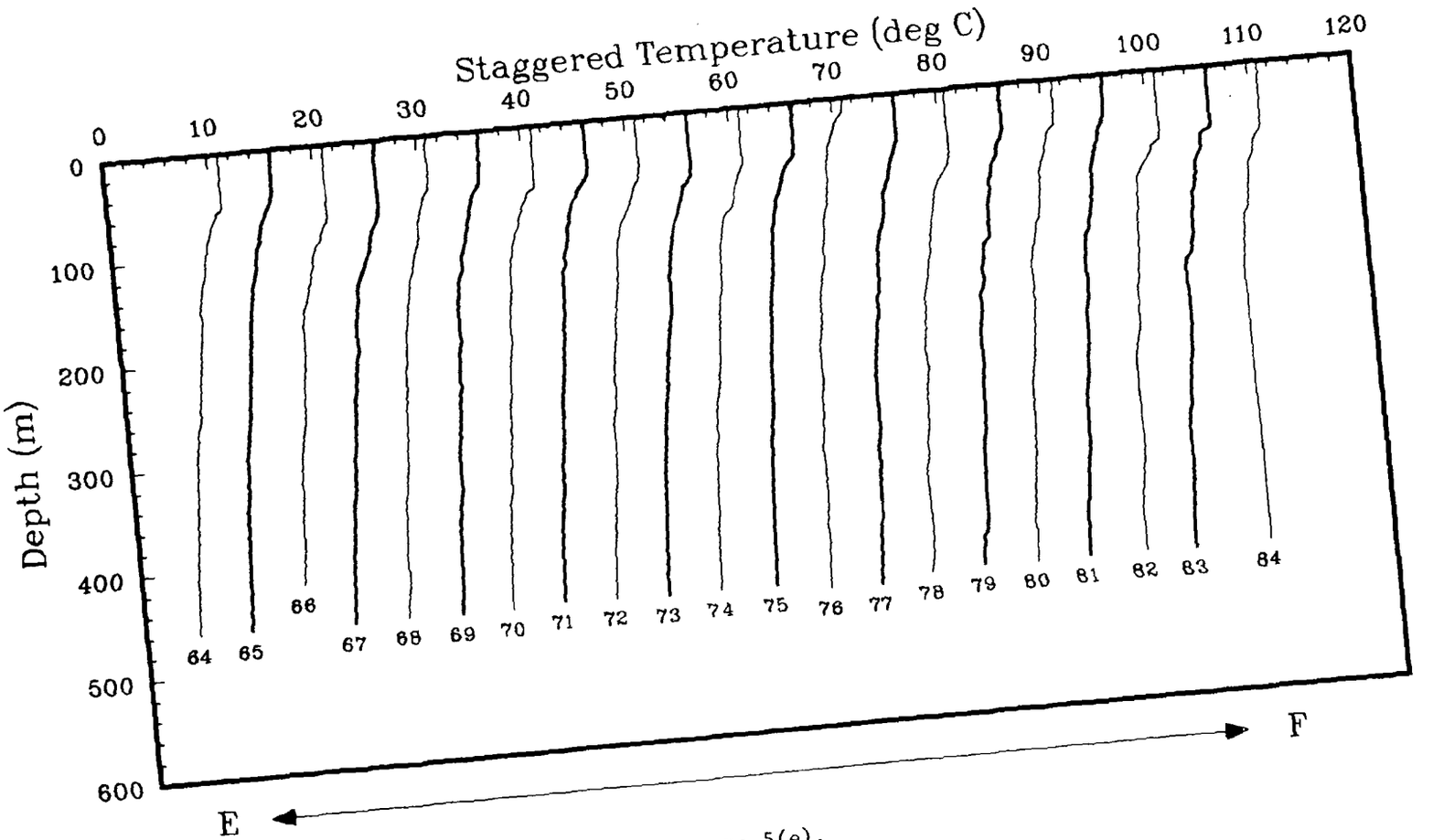
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
E
F

Figure 5(e).

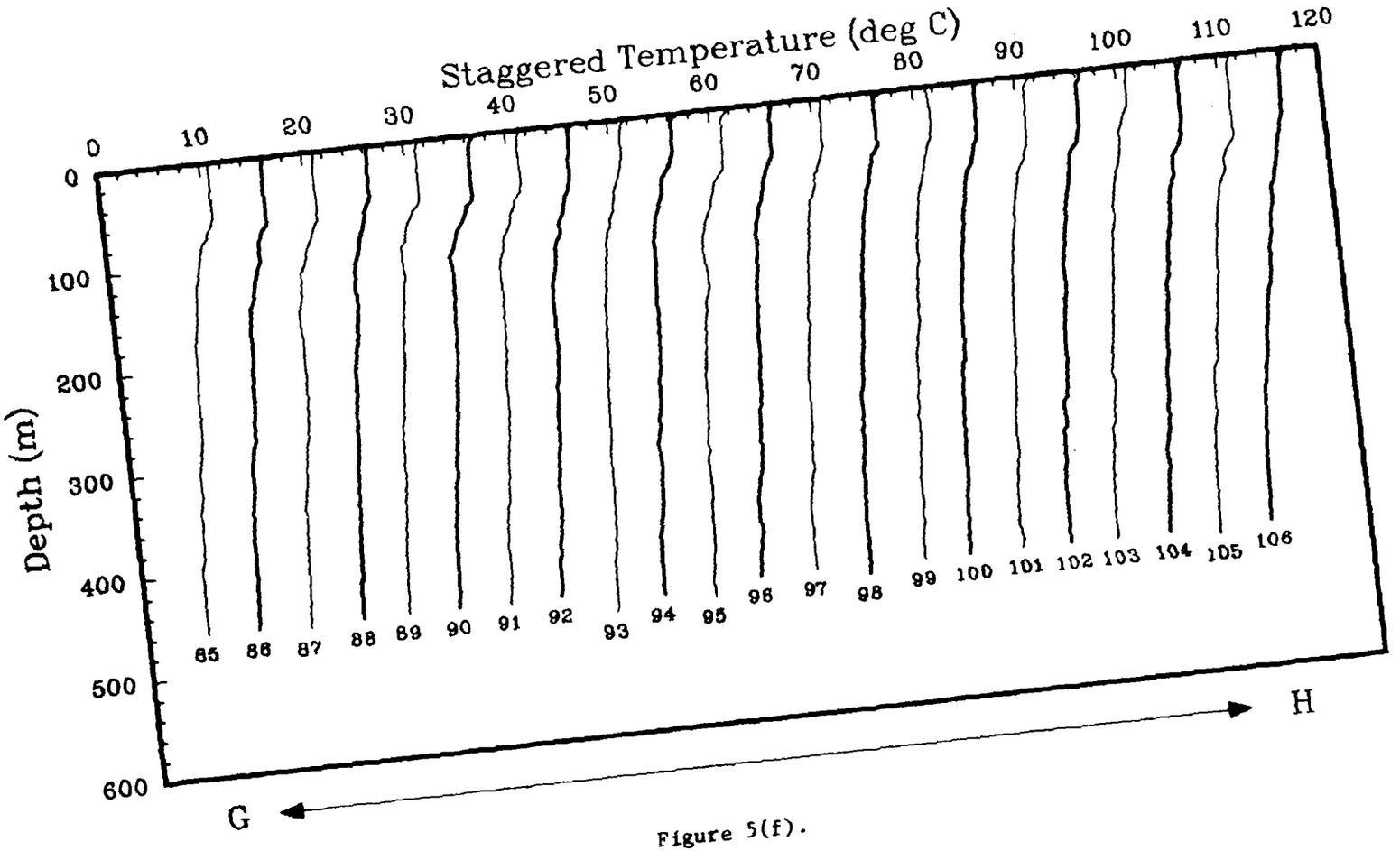
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
G
H

Figure 5(f).

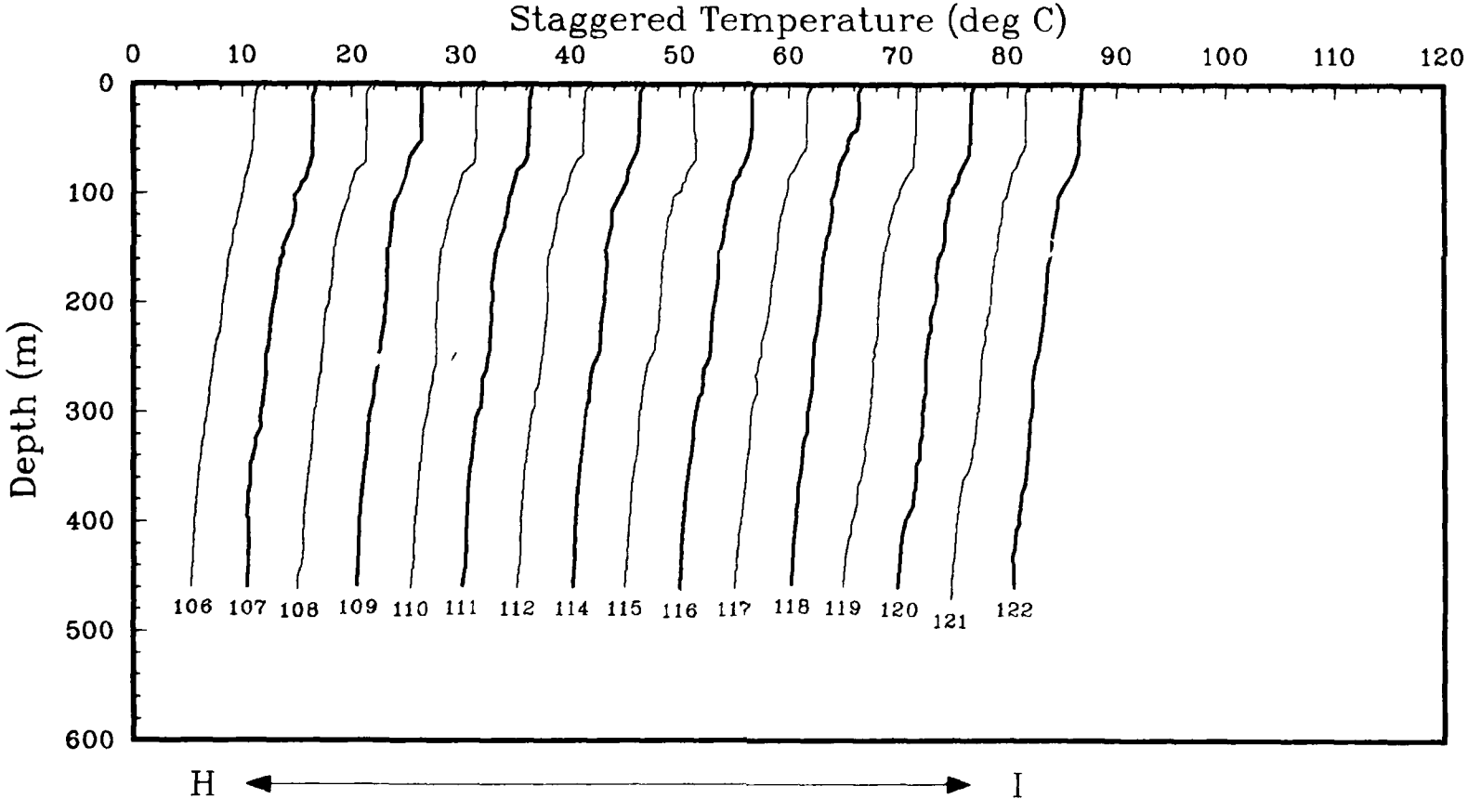
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
106
107
108
109
110
111
112
114
115
116
117
118
119
120
121
122
H
I

Figure 5(g).

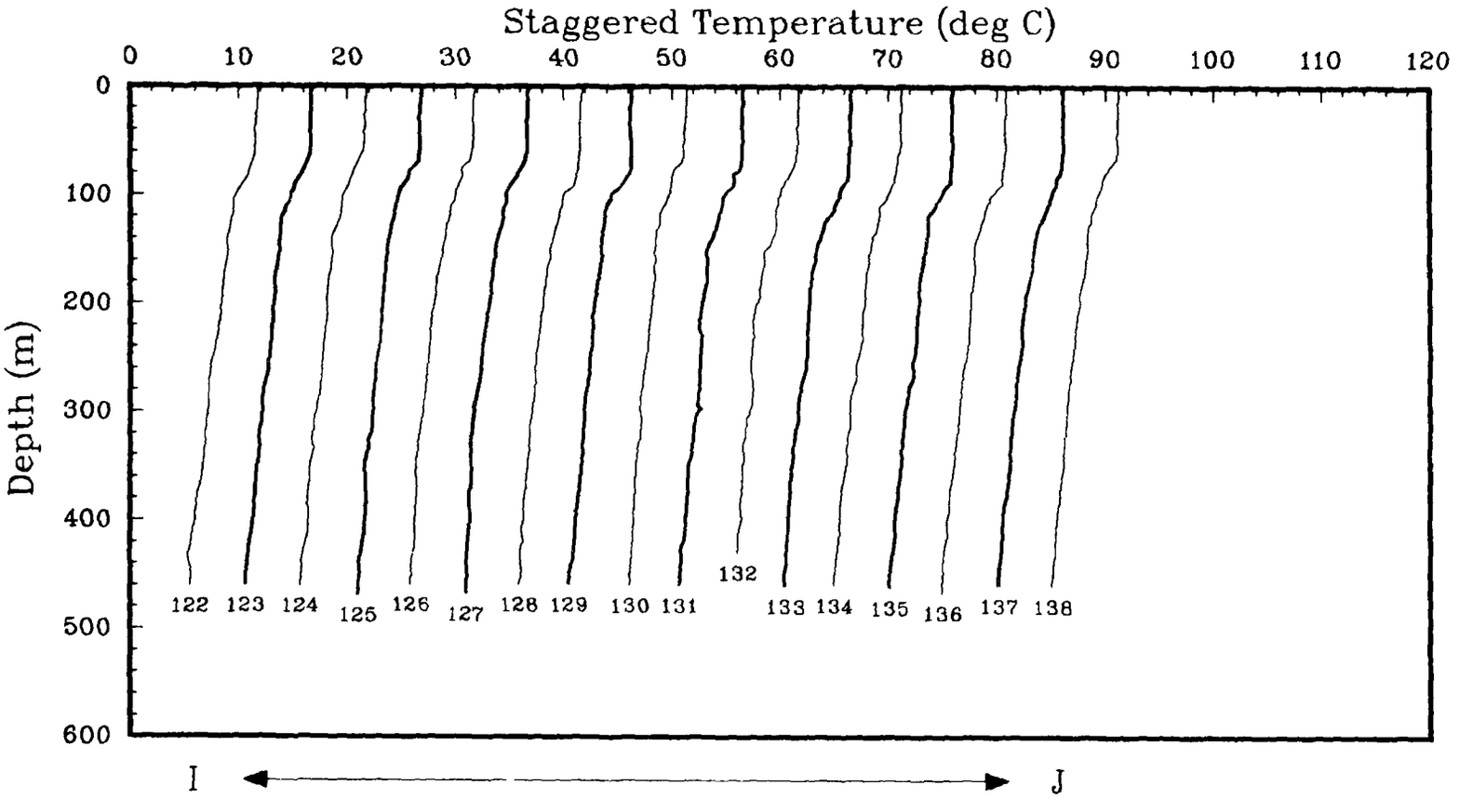
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
I
J

Figure 5(h).

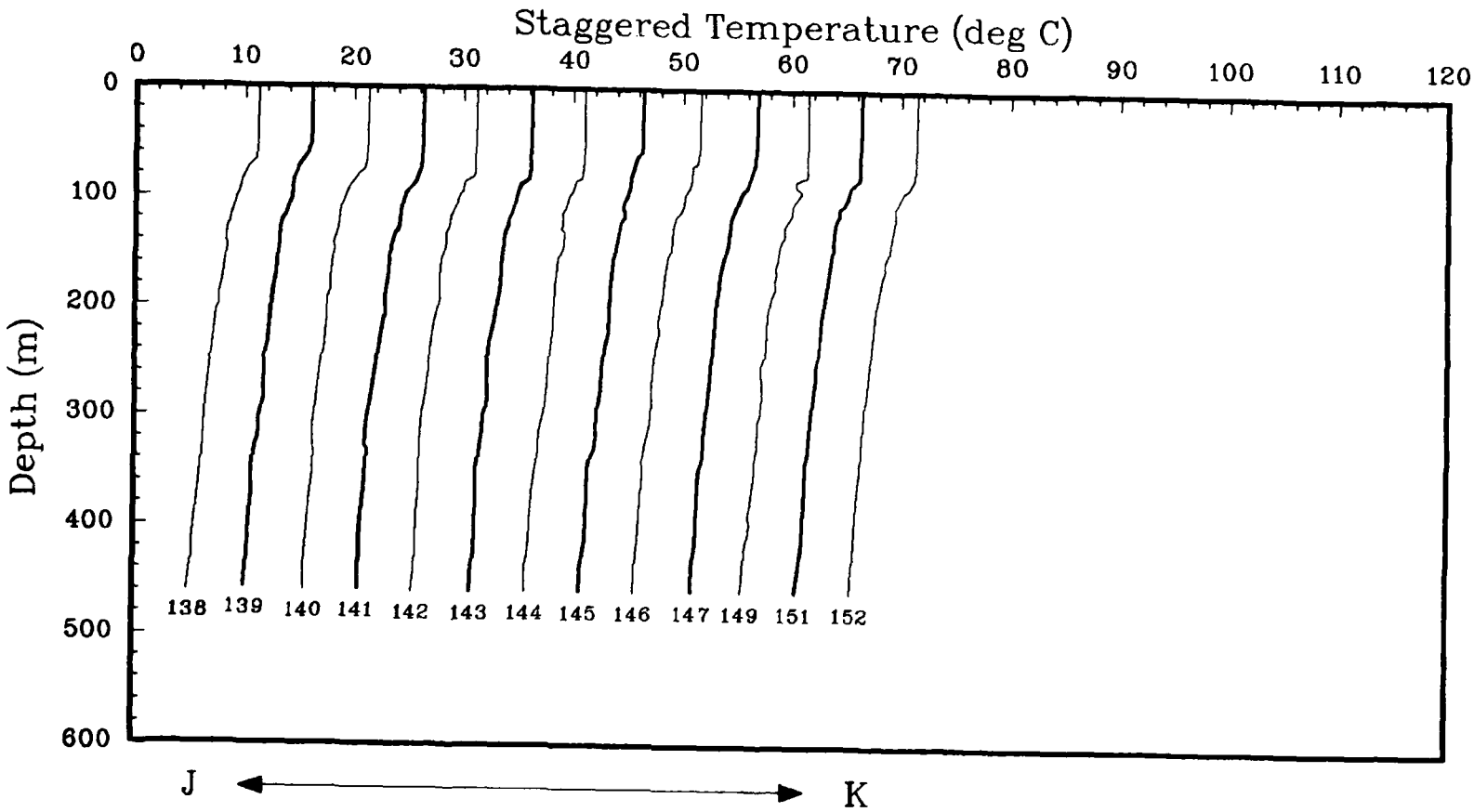
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
138
139
140
141
142
143
144
145
146
147
149
151
152
J
K

Figure 5(i).

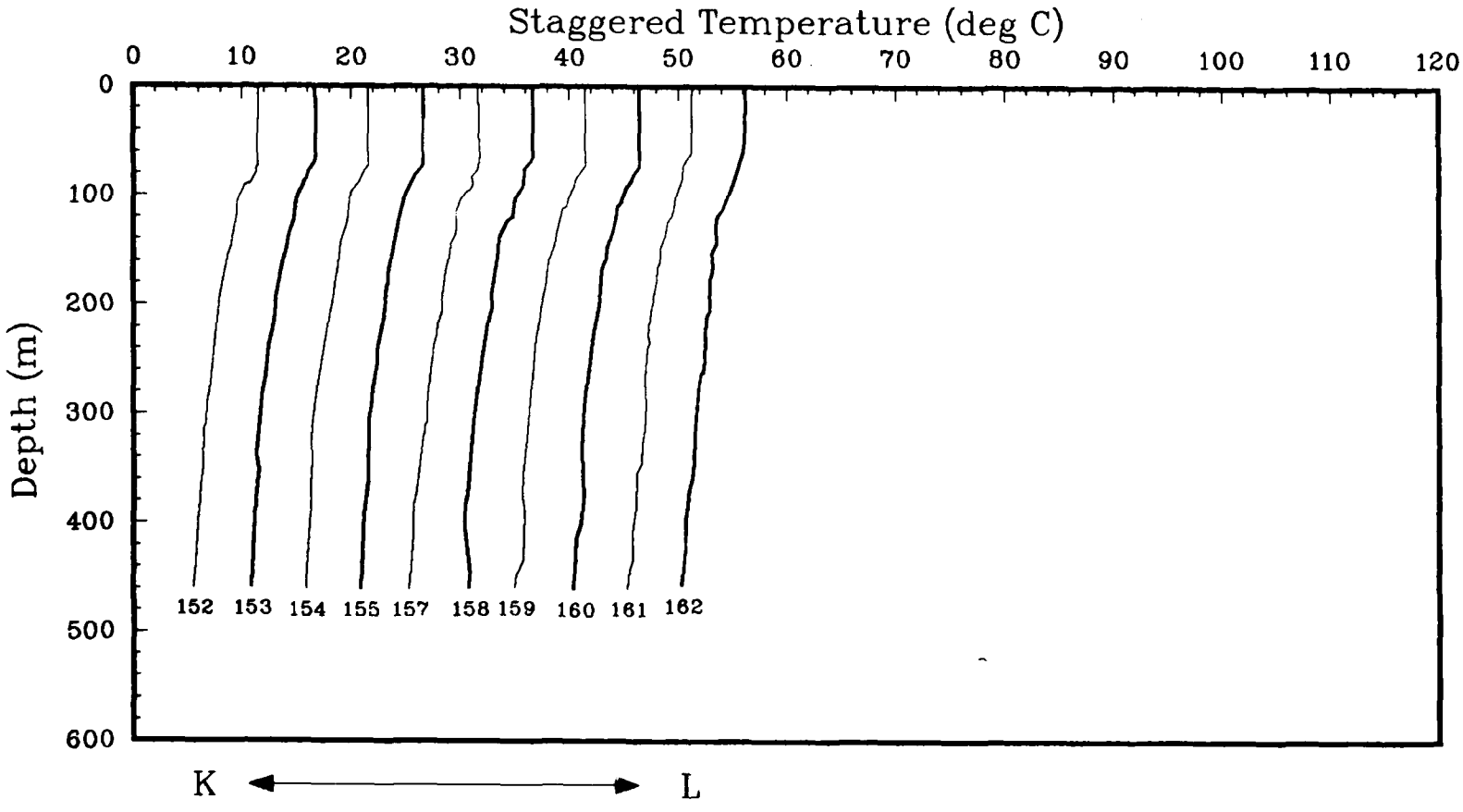
Staggered Temperature (deg C)
0
10
20
30
40
50
60
70
80
90
100
110
120
Depth (m)
0
100
200
300
400
500
600
152
153
154
155
157
158
159
160
161
162
K
L

Figure 5(j).

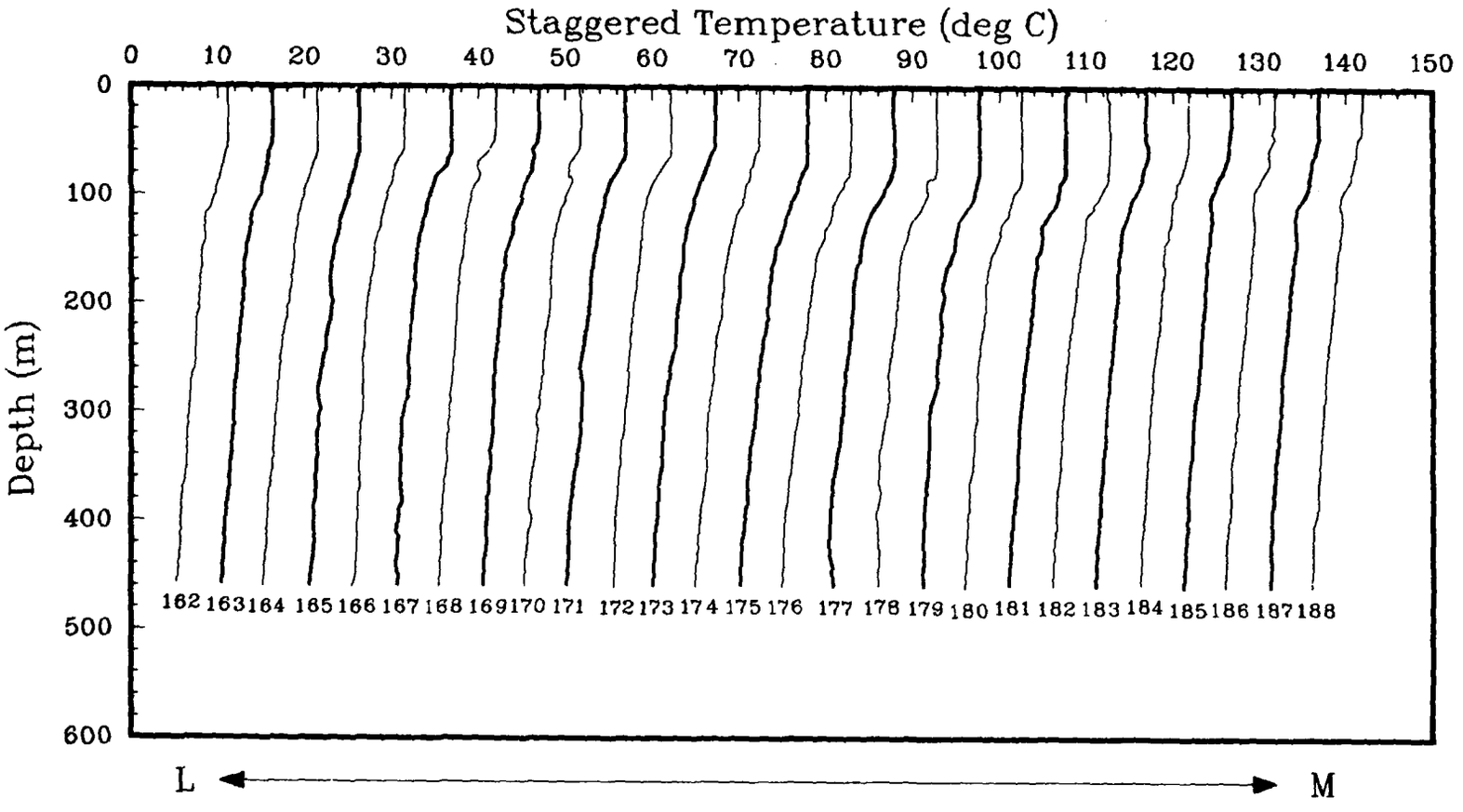
Staggered Temperature (deg C)
0 10 20 30 40 50 60 70 80 90 100 110 120 130 140 150
Depth (m)
0 100 200 300 400 500 600
162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188
L
M

Figure 5(k).

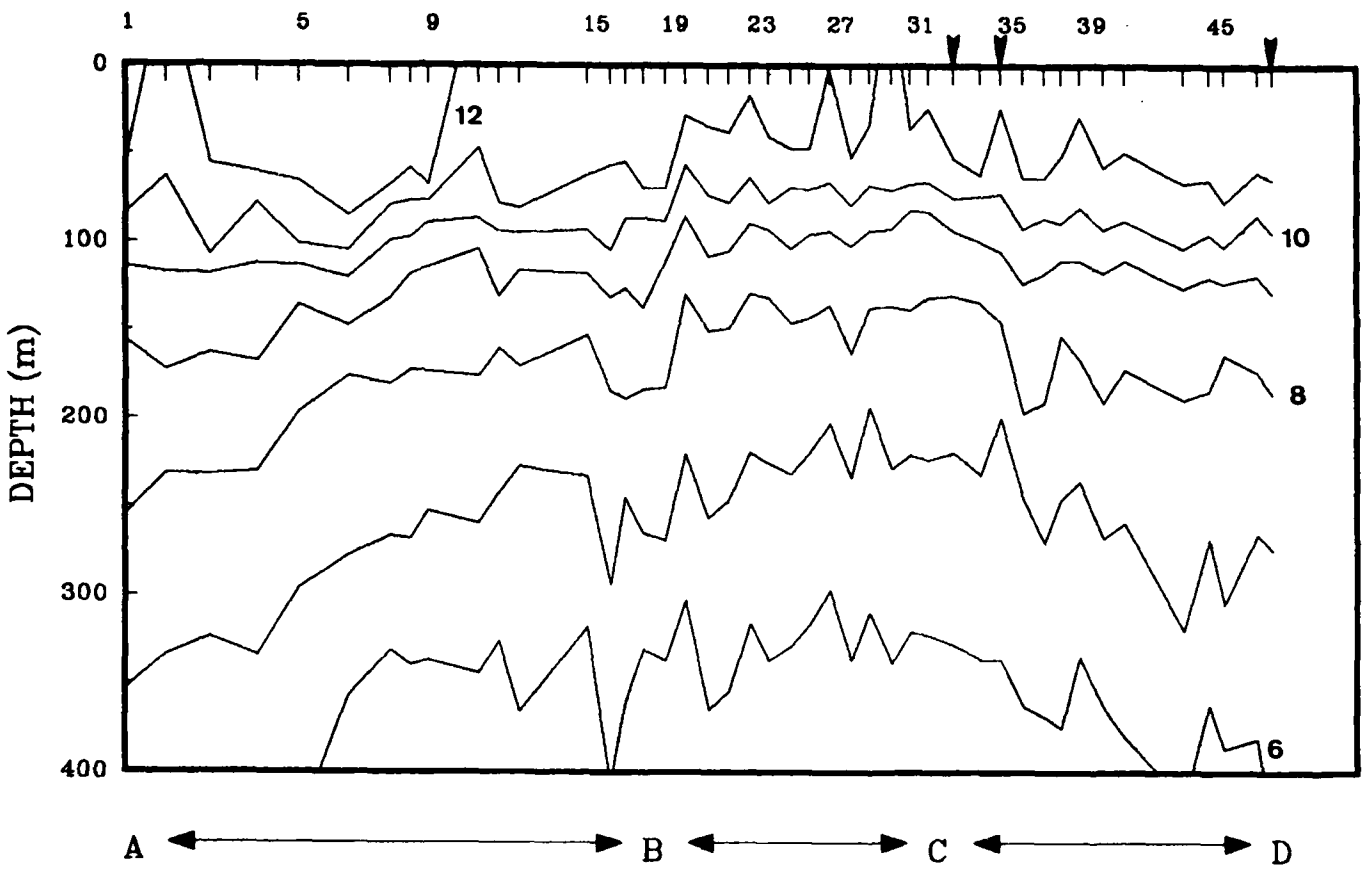

Figure 6(a):

Isotherms from XBTs. Tick marks along horizontal axis show station positions. Some station numbers are shown. Arrows indicate the positions where the cruise track changed direction.

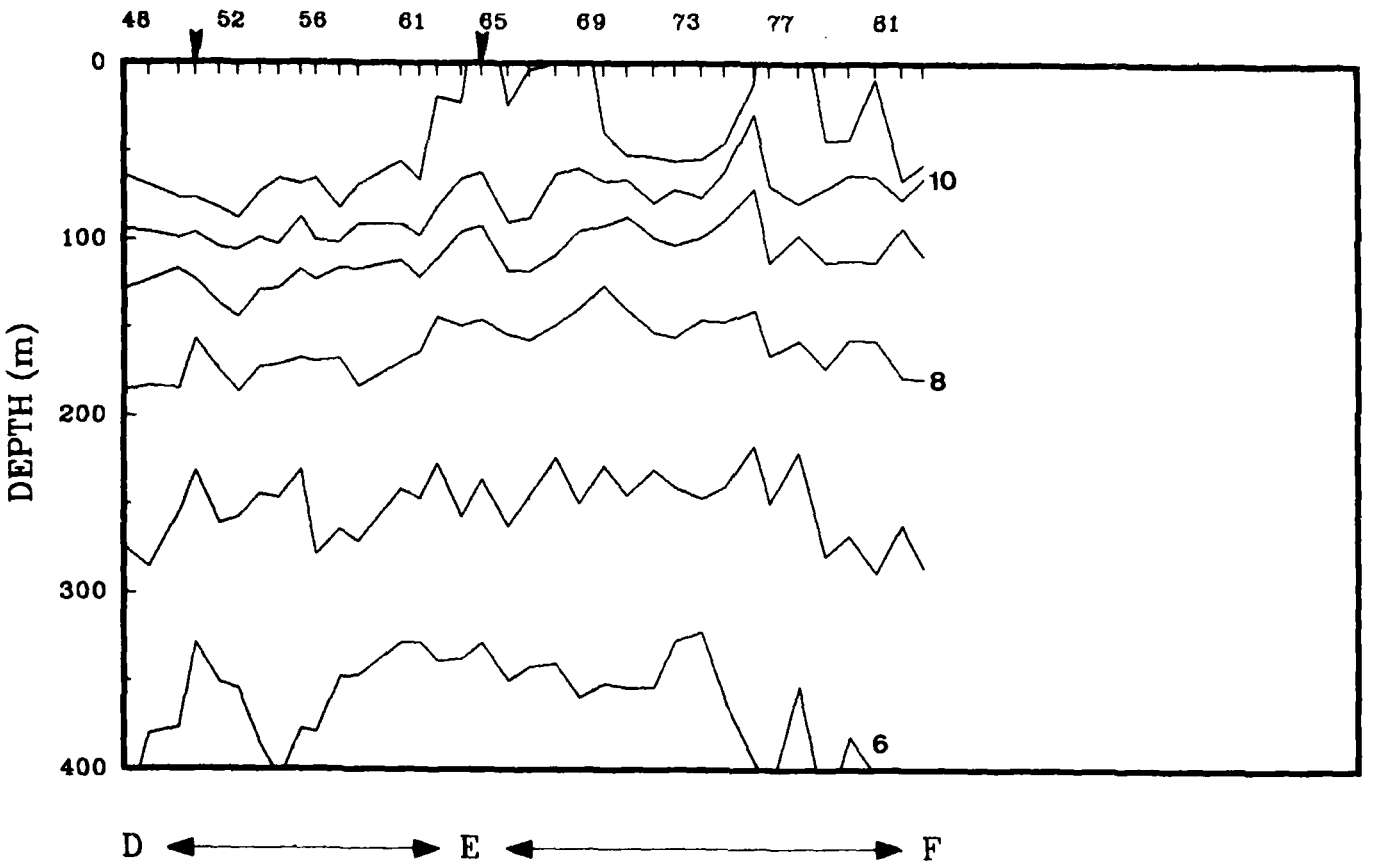

Figure 6(b).

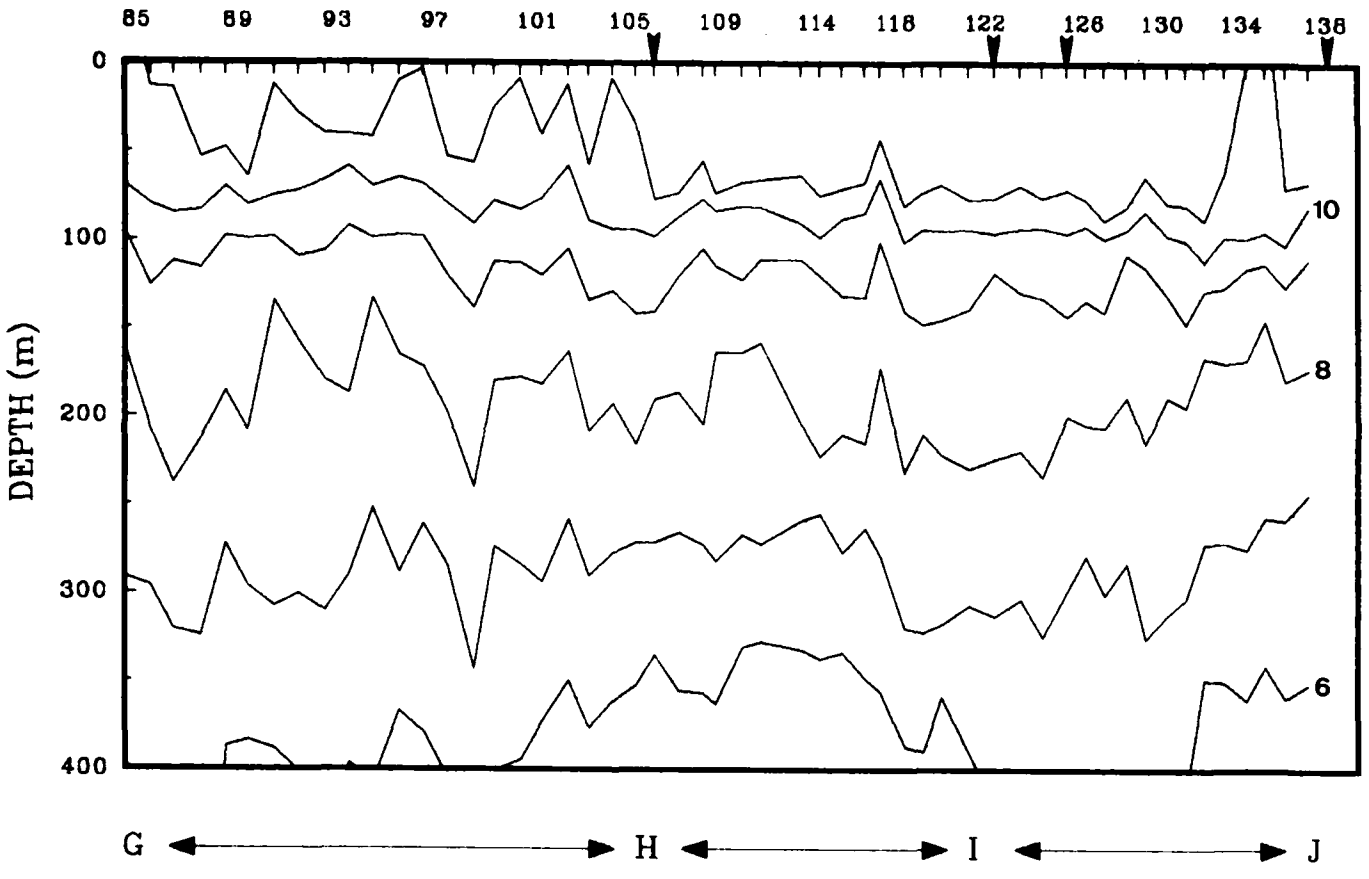
85
89
93
97
101
105
109
114
118
122
126
130
134
138
0
100
200
300
400
DEPTH (m)
10
8
6
G
H
I
J

Figure 6(c).

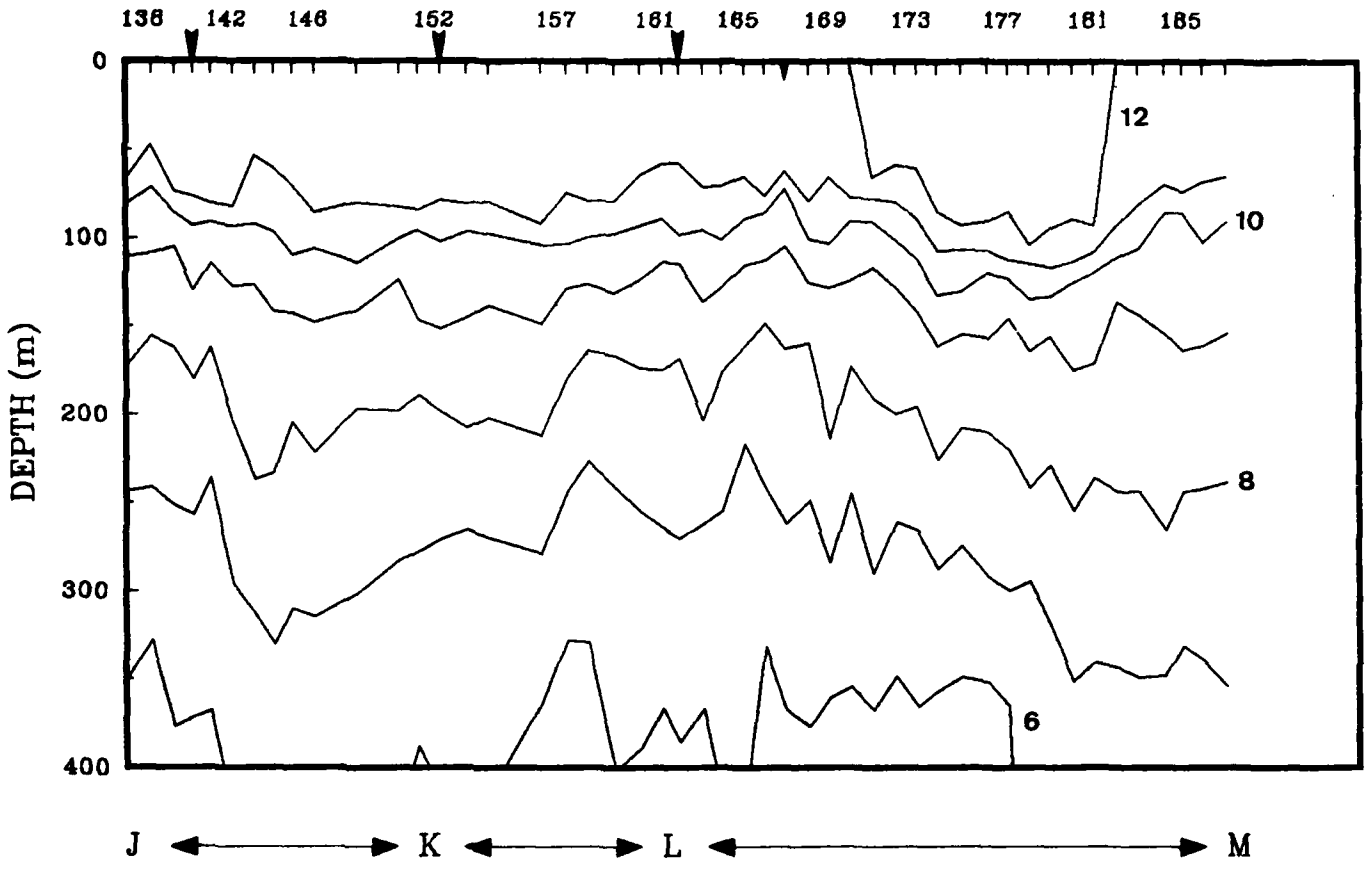
136
142
146
152
157
161
165
169
173
177
181
185
0
100
200
300
400
DEPTH (m)
12
10
8
6
J
K
L
M

Figure 6(d).

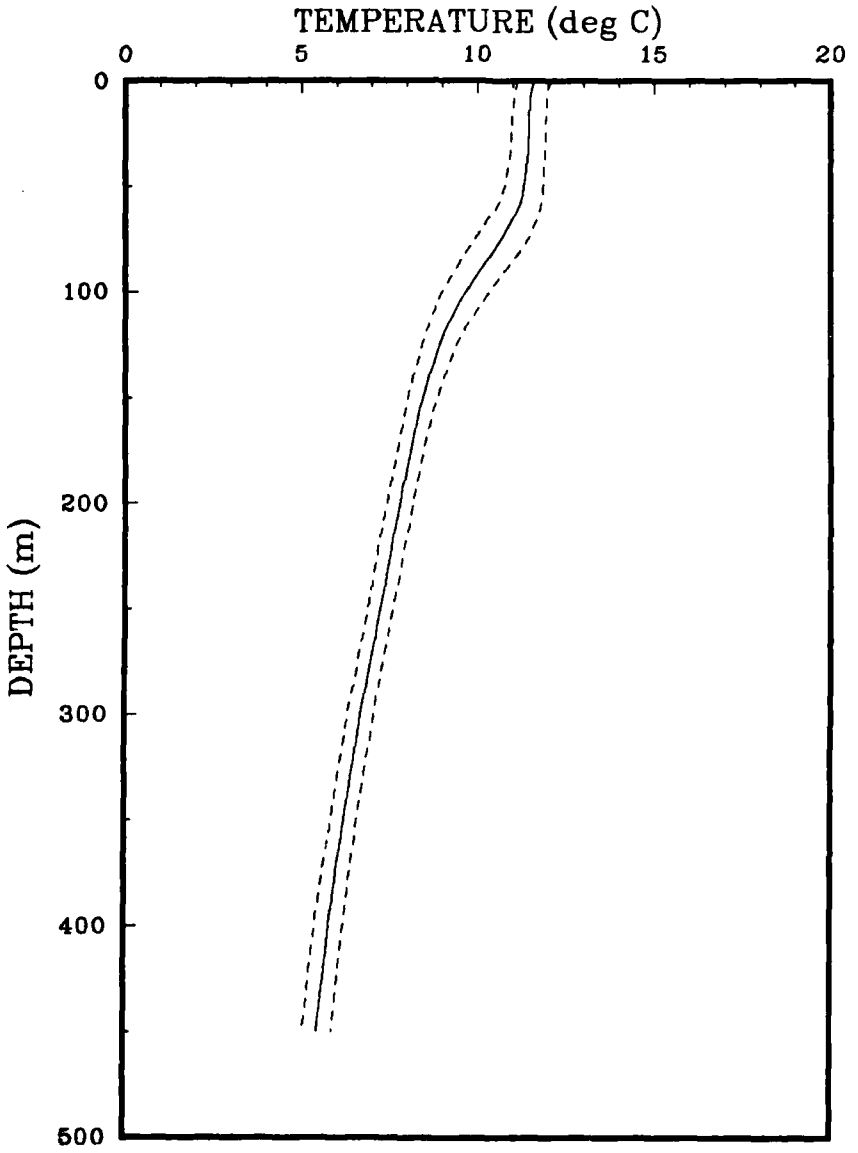

Figure 7:

Profiles of $\overline{T(z)}$ with + and - the standard deviation.

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Prof. Allan R. Robinson, Harvard, Co-Chief Scientist
Dr. Jerome A. Smith, NPS, Deputy Chief Scientist
Mr. Kim McCoy, NPS, Party Chief
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Ens. Kerry Daly, USN, FNOC
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